Space Weather Technical Forecast

Issued on Wednesday, 30 August 2023 at 13:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of isolated M-class flares (R1-R2 Blackouts). Glancing CME arrival possible Day 1 (30 Aug) with a slight chance of G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low, with only minor C-class flares in the past 24 hours. There are currently up to seven sunspot regions on the visible disc. Two of these are relatively large and complex but largely inactive, namely AR3413 and AR3415. AR3417, in the southeast, was the source of the largest flare, reaching C3.9 flare at 29/2327 UTC. However it is now looking stable or even weakening, with spots slowly fading on its trailing edge. The unnumbered region in the northeast is revealing new spots as it continues to rotate onto the disc, now classified as Cro/Beta. The other regions are small and simple.

No Earth-directed CMEs were observed leaving the sun on available imagery over the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as observed by ACE/DSCOVR at L1, were typical of a slow regime. The solar wind was slow-ambient, between 330-350km/s, along with a below average density. The interplanetary magnetic field, Bt, was weak and below 6nT, while its north-south component (Bz) fluctuated erratically between +/-5nT. The Phi angle was predominantly negative (towards the Sun) but shifted positive (away from the sun) at times, possibly indicating a weak connection with the HSS originating from CH38/- (no longer on disc). The results of these aforementioned parameters was a Quiet (kp 0-2) geomagnetic activity.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at background levels. GOES16 high energy (greater than 2MeV) electron flux was mostly at background, only briefly reaching moderate levels with a maximum of 178 pfu at 29/1505 UTC. The associated 24-hour fluence was well below the Active threshold and on a downward trend, with 2.57e6 integrated pfu observed at 30/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: The current Low solar activity is expected to continue with a chance of an isolated M-class flare. The most likely source for this activity probably from AR3417 located in the southeast that produced the last moderate flare.

Solar Wind / Geomagnetic Activity: A CME may give a glancing impact at Earth sometime on Day 1 (30 Aug), though this is low confidence. There are no other Earth-directed CMEs currently forecast. Solar winds are at slow-ambient levels and will probably remain unchanged until the potential CME arrival mentioned above. The next impact on the solar winds looks to be coronal hole (CH40/+) which may give an enhancement to slightly elevated levels into Day 3 (01 Sep). All things considered geomagnetic activity is most likely to remain Quiet. Should the CME materialise, activity may become Unsettled to Active with a slight chance of G1/Minor Storm

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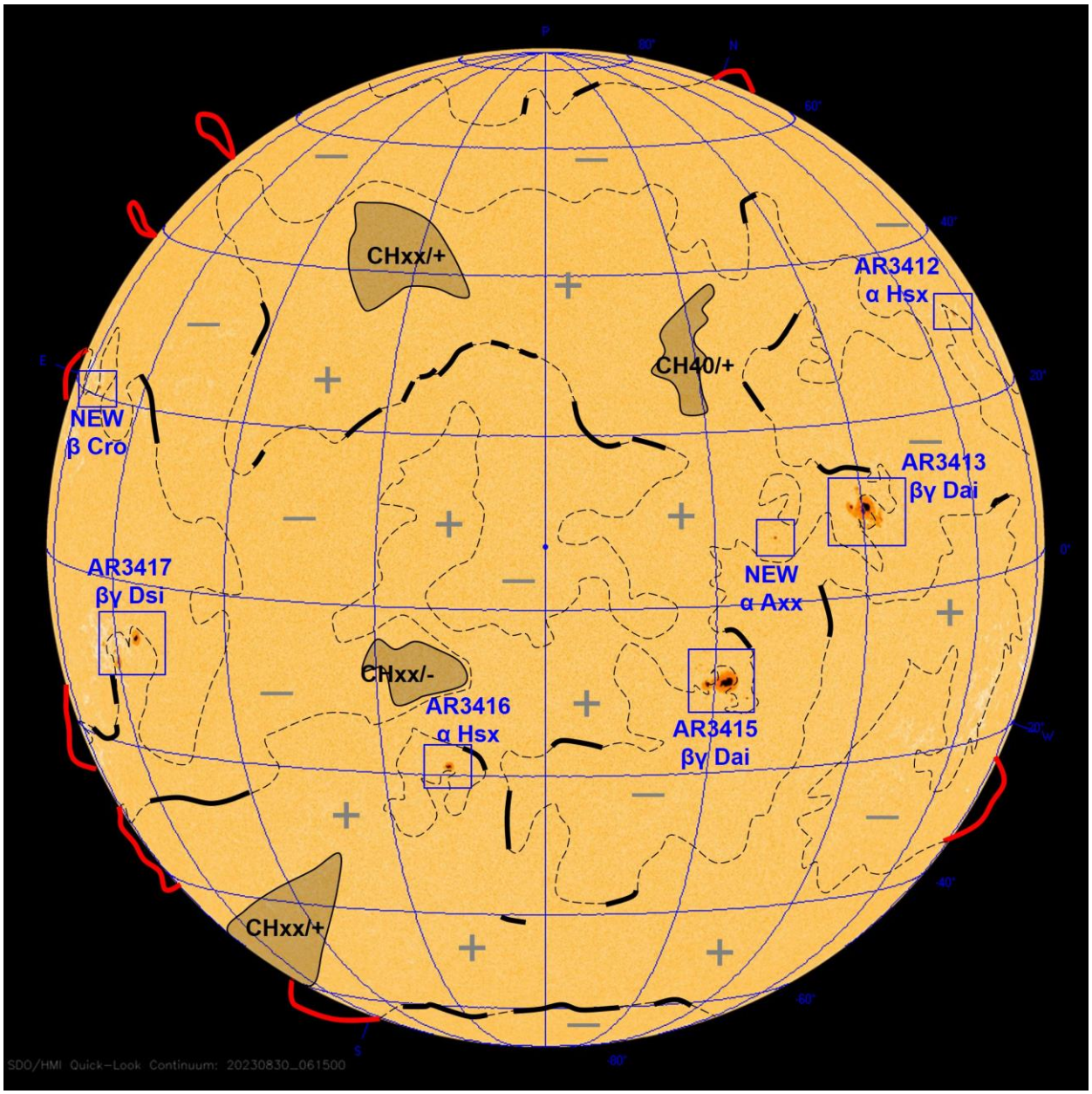
intervals on Day 1 (30 August), with any effects easing into Day 2 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 3 (01 Sep).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background levels, with just a slight chance of enhancement, mainly should any larger flares occur from AR3413 or AR3415. High energy (greater than 2 MeV) electron flux is expected to persist at background to moderate levels. The associated 24 hour fluence is expected to remain below the Active level (1e8 integrated pfu) on a probable flat trend, and may even drift lower in coming days.

Figure 1. Solar Analysis Valid 30/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

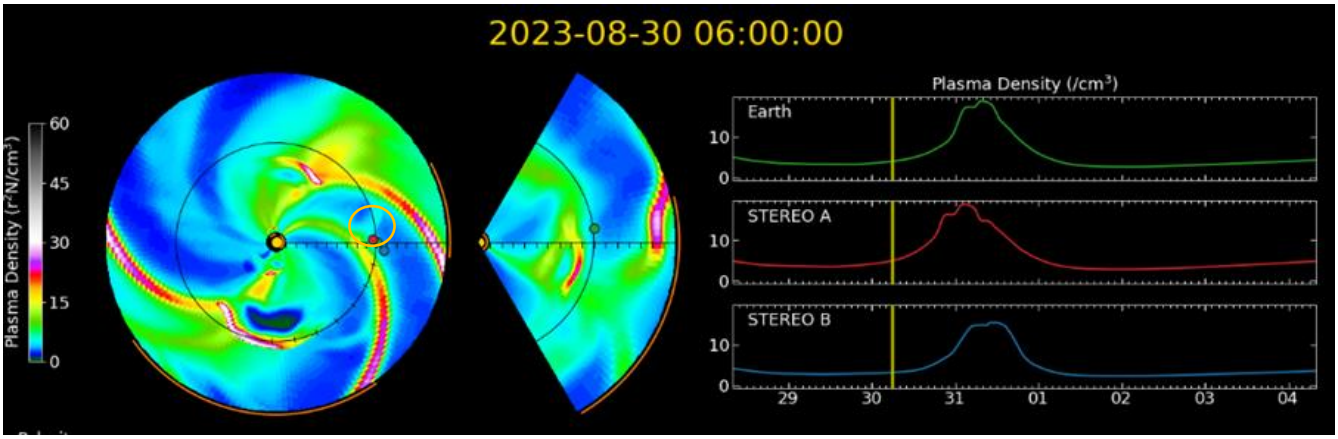
The C2.2 flare and associated dimming from AR3413 at 25/1006 UTC generated a CME, with a very faint eruption subsequently detected in SOHO imagery. Assessment of this gives a probable glancing CME impact at Earth sometime on Day 1 (30 Aug) however confidence is low considering how faint it looked on available imagery. There are no other Earth-directed CMEs currently forecast.

The solar wind is currently not showing any sign of enhancement and remains at slow-ambient levels around 330km/s. There are possibly two high speed streams en-route to Earth however, the associated coronal holes are rather small and distant (further north) from Earth, so much so that any enhancement is likely to be modest and perhaps lead to a few Unsettled or Active geomagnetic intervals. The Met Office Enlil indicates solar winds reaching slightly elevated levels, 450-500km/s, into Day 3 (01 Sep) but this is considered slightly overdone.

All things considered geomagnetic activity is most likely to remain Quiet. Should the CME materialise, activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals on Day 1 (30 August), with any effects easing into Day 2 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 3 (01 Sep).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil and ensemble showing possible glancing CME blow (amber circle) arriving today (30th), though low confidence given spread of ensemble members.



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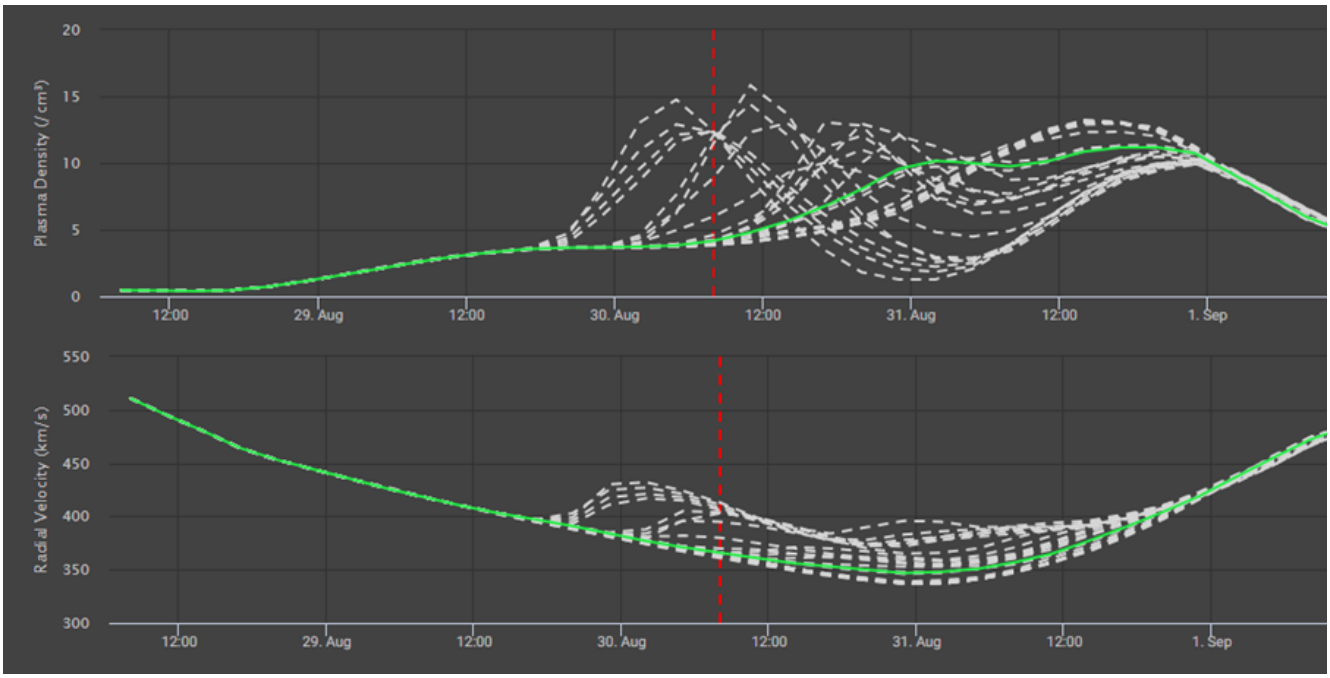
Met Office Space Weather Technical Forecast



Radio Blackouts - X-Ray Flares:

There are currently up to seven sunspot regions on the visible disc. Three of these are small and simple. Of the three main sunspot groups, two are relatively large and complex but largely inactive, namely AR3413 and AR3415. AR3413, in the northwest, has not changed much although it has lost a few spots on the leading edge. AR3415, in the southwest, saw a proliferation of rudimentary spots for a time but most of them seem to be fading now. AR3417, in the southeast, consists of a leading spot with penumbra and several spots with rudimentary penumbrae. It is followed by a large plage but looks stable or even weakening, with spots slowly fading on its trailing edge. The unnumbered region in the northeast is revealing new spots as it continues to rotate onto the disc, now classified as Cro/Beta.

The current low solar activity is expected to continue during the forecast period, with only a slight chance of an isolated M-class flares, either from AR3413/AR3415 or perhaps more likely from AR3417 in the southeast given previous history of recent M-class flare activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

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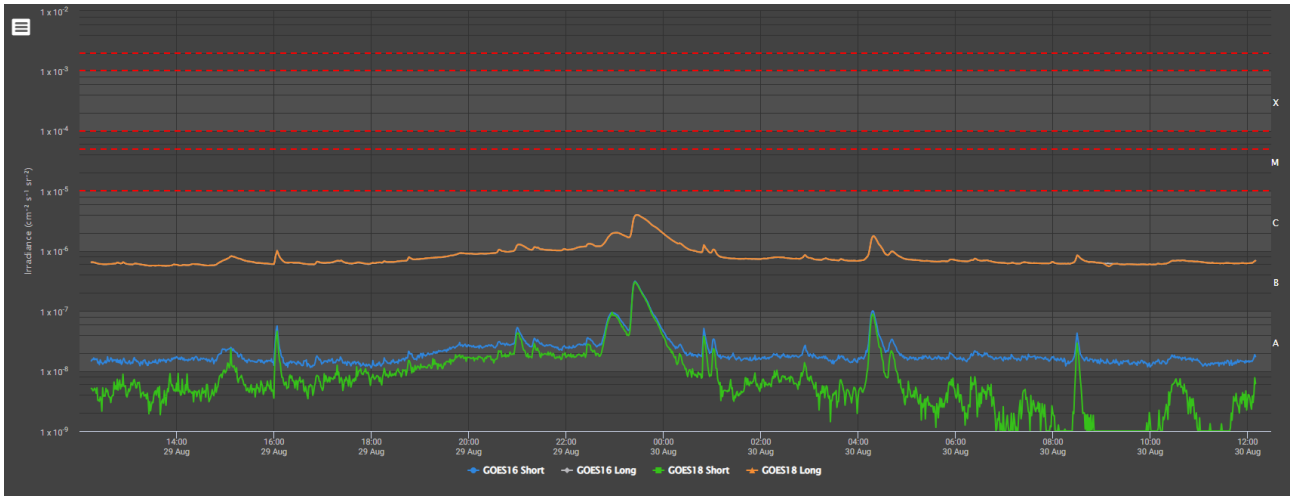
Figure 3: Latest X-Ray flare activity, as observed by GOES16



Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at background levels with just a slight chance of enhancement. The main risk of any increased proton flux would be from the occurrence of any larger flares from AR3415 or AR3413.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy (greater than 2 MeV) electron flux observed by GOES16 is expected to remain at background to moderate levels for much of the period, given a lack of recent electron enhancement. There is a slight chance of a glancing blow from a CME on Day 1 (30 Aug). This may populate the Van Allen belts with charged particles once the initial shock wave has passed but confidence is low and the most likely scenario is for the electron flux to remain at background levels.

The associated 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) level, with any rise in fluence likely to be modest. This is supported by the Met Office REFM output, which currently appears to offer sensible advice.

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GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	5	5	5
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: Latest High Energy Electron Flux, as observed by GOES16

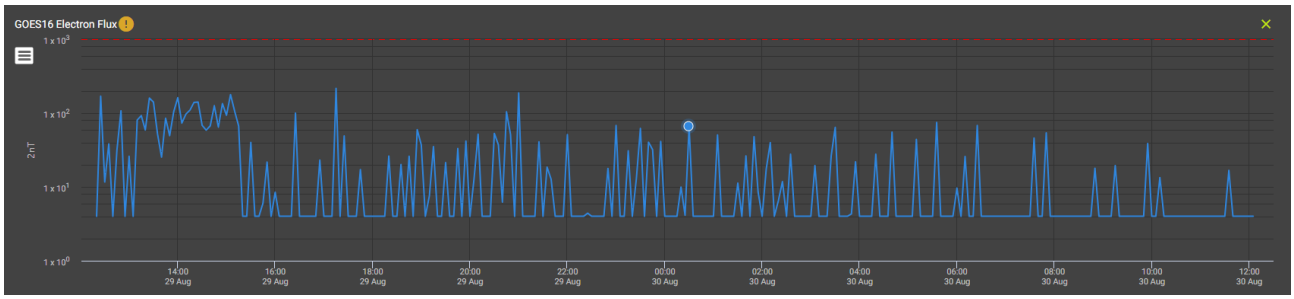
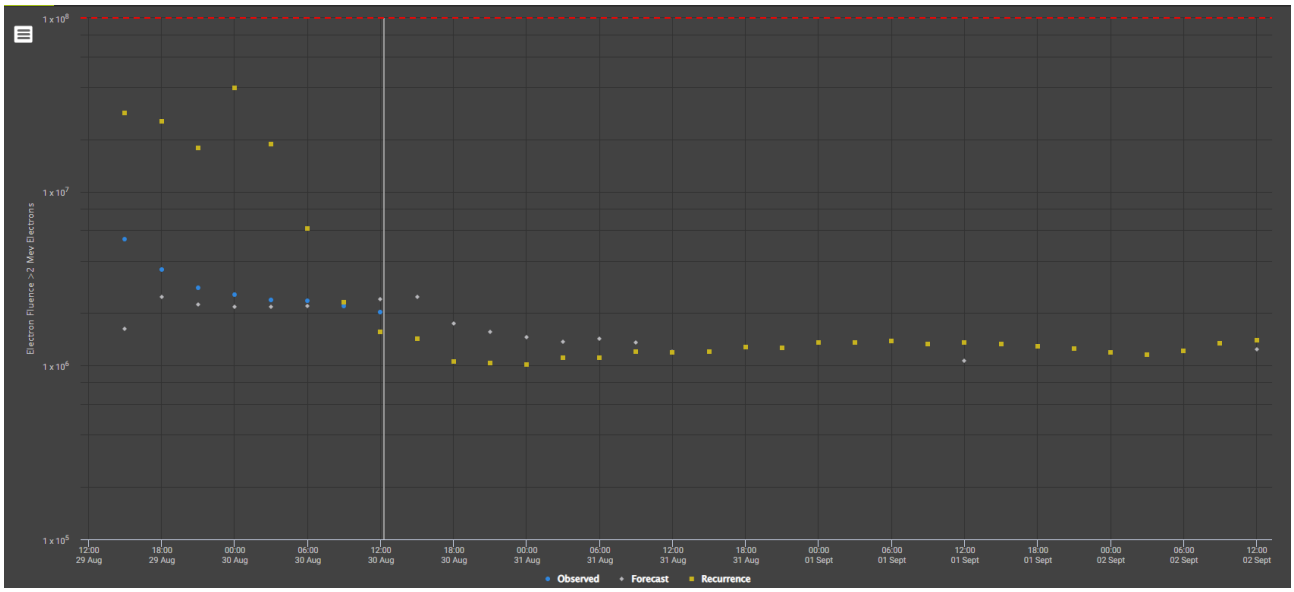


Figure 4: Latest Met Office REFM output



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